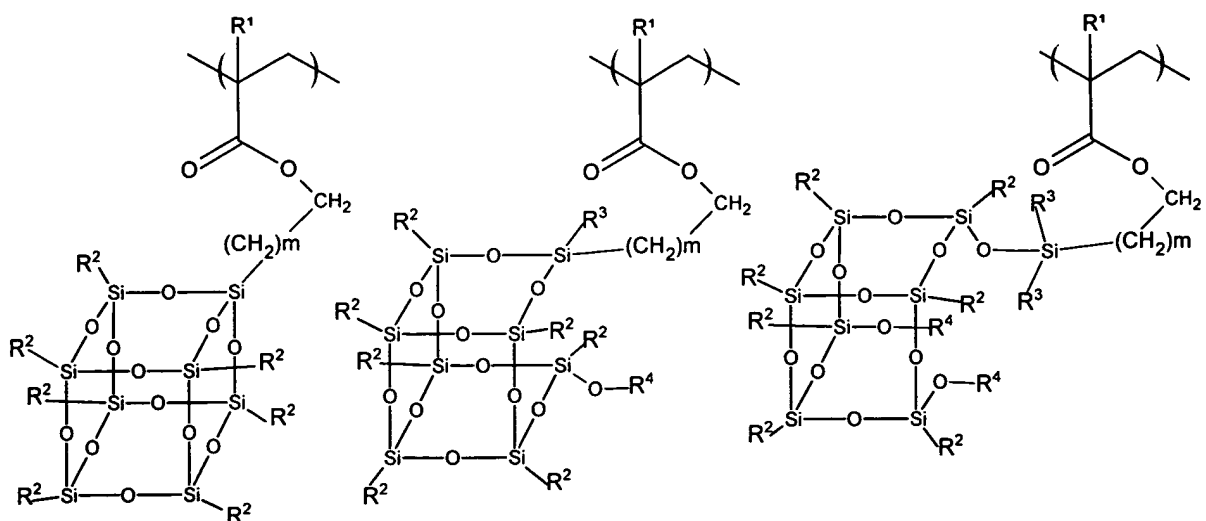


### Abstract

Novel copolymers suitable for forming the top layer photoimable coating in a deep UV, particularly a 193nm and 248 nm, bilayer resist system providing high resolution photolithography. Chemically amplified photoresist composition and organosilicon moieties suitable for use in the binder resin for photoimable etching resistant photoresist composition that is suitable as a material for use in ArF and KrF photolithography using the novel copolymers.

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Novel copolymer include a first repeating unit of one or more units represented by Structure (IA) or Structure (IB) or Structure (IC)

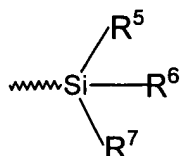


**Structure (IA)****Structure (IB)****Structure (IC)**

wherein each  $R^1$  is independently a hydrogen atom or a methyl group;  $R^3$  is a linear, branched and cyclic alkyl or alicyclic group having 1 to 20 carbon atoms; m is an integer about 2 to about 10.

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each  $R^4$  can independently be H or Structure (II),

**Structure (II)**

wherein  $R^5$ ,  $R^6$  and  $R^7$  are independently linear, branched or cyclic alkyl or alicyclic

10 or fluoroalkyl group having 1 to 20 carbon atoms;.

where each  $R^2$  can independently be:

(a) linear, branched or cyclic alkyl unsubstituted or substituted alicyclic group, having 1 to 20 carbon atoms;

15 (b) linear, branched or cyclic fluoroalkyl or fluorine substituted alicyclic group having 1 to 20 carbon atoms; and

a polar group, such as

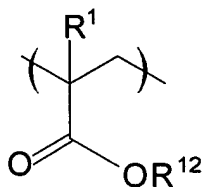
(1)  $(CH_2)_n-OR^8$ , where n is an integer from about 2 to about 10 and  $R^8$  can be H,  $R^3$  group or  $\alpha$ -alkoxy alkyl group;

20 (2)  $(CH_2)_n-(C=O)-OR^9$ , where n has the same meaning as defined above and  $R^9$  can be H,  $R^3$  group or an acid sensitive protecting group;

(3)  $(CH_2)_n-C(CF_3)R^{10}-OR^{11}$ , where n has the same meaning as defined above and  $R^{10}$  can be H or fluoromethyl, difluoromethyl or trifluoromethyl and  $R^{11}$  can be H or  $R^3$  alkyl group; and

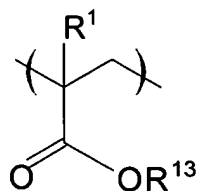
25 (4)  $(CH_2)_n-O-(C=O)R^3$ , where n has the meaning above; and  $R^3$  is a linear, branched and cyclic alkyl or alicyclic group having 1 to 20 carbon atoms; and

a second repeating unit represented by Structure (III)



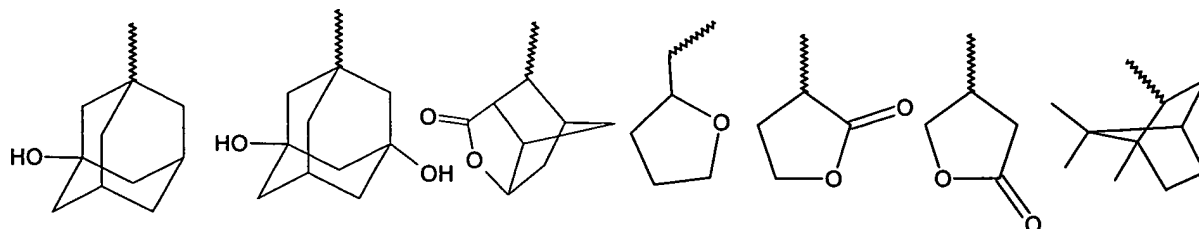
**Structure (III)**

wherein R¹ has the same meaning as defined above and R¹² is an acid labile group, with the proviso that when Structure (IA) is present in the copolymer and R¹² is t-Bu, an additional repeating unit having Structure (IV), or Structure (VI), or a repeating unit derived from an ethylenically unsaturated, polymerizable silicon compound different from Structures (IA), (IB), and (IC), as defined hereinafter, must be present, and where Structure (IV) is as follows:



**Structure (IV)**

wherein R¹ has the same meaning as defined above and R¹³ is selected from the group consisting of the following structures (Va - Vg).



**(Va)**

**(Vb)**

**(Vc)**

**(Vd)**

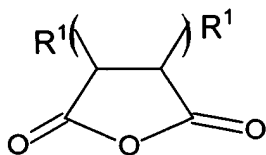
**(Ve)**

**(Vf)**

**(Vg)**

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and Structure (VI) is



**Structure (VI)**

5        where R<sup>1</sup> has the meaning as defined above.